REMARKS/ARGUMENTS

The claims are 1 and 4-6. Independent claim 1 has been amended to more clearly define the invention and to incorporate the subject matter of dependent claim 2, which claim has been canceled without prejudice. No new matter has been added. Reconsideration is expressly requested.

Claims 1-2 and 4-6 were rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. In particular, the Examiner has taken the position that the feature "***without further processing***" as recited in amended claim 1 is not supported in the specification as originally filed, and accordingly constitutes new matter.

In the Examiner's view, the feature of passing the process gas that leaves the reaction oven back into the coke oven gas ***without further processing*** was not described in the specification in such a way to reasonably convey to one skilled in the relevant art that the inventors at the time that the application was filed had possession of the claimed invention.

In response, Applicant respectfully submits that the feature of passing the process gas that leaves the reaction oven back

into the coke oven gas without further processing, was described in the specification in such a way to reasonably convey to one skilled in the relevant art that the inventors at the time that the application was filed had possession of the claimed invention.

In particular, claim 1 as originally filed specifies that the Claus plant is operated with only a single reaction oven and that, after precipitation of the condensed sulphur, the process gas is passed back into the coke oven gas ***with a residual content of hydrogen sulphate that was not converted in the reaction oven.*** This feature clearly discloses that there is no further conversion or transformation of the hydrogen sulfide after leaving the single reaction oven, i.e. the process gas is past back *without further processing.* This is an essential feature of the application as a comparable high amount of residual hydrogen sulfide is accepted. As the process gas is passed back into the coke oven gas to be cleaned, ahead of the gas scrubbing, a further processing is neither necessary nor provided (*See e.g.*, the paragraph bridging pages 4 and 5 of the specification as filed).

Moreover, the drawings figures as filed also clearly disclose and support the feature of passing the process gas that

leaves the reaction oven back into the coke oven gas ***without further processing***. FIG. 1, for example, shows that the process gas 5, which contains a non-reacted residual content of hydrogen sulfide, is past back to the coke oven gas COG to be cleaned, ahead of the gas scrubbing 1. According to the description provided, for example at the first full paragraph on page 6 of the specification as filed and FIG. 1, it is clear that there is no further processing of the process gas 5 between the Claus plant and the coke oven gas ahead of the gas scrubbing.

As set forth in the paragraph bridging pages 6 and 7 of the specification as filed, the Claus plant 4, which is shown in FIG. 1 as a block, is described in detail in FIG. 2. According to FIG. 2, only a single reaction oven 8 is provided. The process gas leaving the reaction oven 8 is cooled to a temperature required for condensation of the sulphur. After precipitation of the condensed sulphur, the process gas 5, which still contains a residual content of hydrogen sulfide, is passed back into the coke oven gas to be cleaned, ahead of the gas scrubbing. The reference number 5 in FIG. 2 corresponds to the reference number 5 in FIG. 1. Thus, from the combination of FIG. 1 and 2, it is clear that no further processing of the process gas is provided.

Accordingly, upon consideration of the disclosure in its

entirely, it is submitted that one skilled in the relevant art would recognize and appreciate that the feature of passing the process gas that leaves the reaction oven back into the coke oven gas without further processing was described in the specification as filed in such a way to reasonably convey to one skilled in the relevant art that the inventors at the time that the application was filed had possession of the claimed invention. Accordingly, Applicant submits that the pending claims are in compliance with the written description requirement of 35 U.S.C. §112, first paragraph.

In view of the foregoing, Applicant submits that the rejections under 35 U.S.C. §112, first paragraph are overcome and Applicant respectfully requests that the rejections of the pending claims on this basis be withdrawn.

Although the previous rejections of the claims under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of *Tarhan et al. U.S. Patent No.* 4,124,685 in view of *Hyde U.S. Patent 4,940,081* have been withdrawn in view of Applicant's remarks filed July 1, 2010, a new ground of rejection has been made based on *Laslo et al. U.S. Patent 4,198,386* in view of *Hyde et al.*

In particular, claims 1, 2, 4 and 5 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,198,386 to *Laslo et al.* in view of U.S. Patent No. 4,940,081 to *Hyde* as evidenced by U.S. Patent No. 4,507,275 to *Reed*, U.S. Patent No. 5,676,921 to *Heisel et al.* and U.S. Patent No. 5,845,610 to *Hatta et al.* Claim 6 was rejected under 35 U.S.C. §103(a) as being unpatentable over *Laslo et al.* in view of *Hyde* and further in view of U.S. Patent No. 5,628,977 to *Heisel et al.*

Essentially, it was the Examiner's position that *Laslo et al.* teaches a method for isolating hydrogen sulfide substantially as recited in claims 1, 2, 4 and 5 with the exception of operating the reaction oven in a temperature range between 200°C and 250°C, which was said to be disclosed in *Reed*, the use of a boiler lined with a refractory material lying horizontally as a Claus boiler, which was said to be shown in *Hatta et al.*, and the use of checker brick which was said to be disclosed in *Hyde*.

With regard to claim 6, the Examiner has taken the position that U.S. Patent No. 5,628,977 to *Heisel et al.* teaches a process wherein the Claus furnace waste gas at hand in pipe 21 after cooling 19 is mixed with hotter Claus waste gas from pipe 13 and fed to pipe 22, fed via pipe 22 to catalytic reactor 23. In the

Examiner's view, it would have been obvious to have a branch of waste gas from the Claus furnace mix with the waste gas to the catalytic oven, as disclosed by *Heisel et al.* in the gas stream of the catalytic reactor of *Laslo et al.* in order to achieve the advantages described.

The rejections are respectfully traversed.

As set forth in amended claim 1, Applicant's invention provides a method for isolating hydrogen sulfide from coke oven gas with subsequent recovery of elemental sulfur in a Claus plant, in which method the hydrogen sulfide is removed from the coke oven gas by means of gas scrubbing with an absorption liquid, the charged absorption liquid is regenerated, and hydrogen sulfide that occurs in concentrated form in this connection is passed to the Claus plant. The purified coke oven gas can be passed for further use.

In the Claus plant, a known Claus process is carried out, in which the hydrogen sulfide is combusted with oxygen in a Claus boiler, and reacted, forming elemental sulfur. The elemental sulfur that has been formed is then precipitated by means of cooling, whereby residual contents of hydrogen sulfide (H_2S) and sulfur dioxide (SO_2) are catalytically reacted to form sulfur.

As further recited in Applicant's amended claim 1, the Claus plant is operated with only a single reaction oven in such a manner that 80% to 85 % of the hydrogen sulfide is converted to elemental sulfur and drawn off as a condensate. The single reaction oven is operated in a temperature range between 200°C and less than 230°C. The process gas that leaves the reaction oven, after precipitation of the condensed sulfur, is passed back into the coke oven gas, without further processing, to be cleaned, ahead of the gas scrubbing, with a residual content of hydrogen sulfide that was not converted in the single reaction oven. A boiler lined with a refractory material, lying horizontally, is used as the Claus boiler, which has a combustion chamber and a catalyst chamber having a catalyst bulk material, which follows horizontally and is delimited on both sides by gas-permeable checker bricks.

It is respectfully submitted that the cited references, whether considered alone or in combination, fail to disclose or suggest a method for isolating hydrogen sulfide from coke oven gas as set forth in Applicant's amended claim 1.

In particular, claim 1 as amended specifies that the Claus plant is operated in a completely uncommon way with only a single reaction oven, in such a manner that only 80 to 85 % of the hydrogen sulfide is converted to elemental sulphur. This feature

is disclosed at page 7 of the specification as filed. In contrast to the common effort to maximize the rate of conversion, the present invention is based on the finding that strict requirements with respect to the protection of nature can be satisfied using a method incorporating an uncompleted conversion of hydrogen sulfide. Accordingly, the set up and operation of the Claus plant are significantly simplified in the method specified in Applicant's claims.

Claim 1 as amended further specifies that the single reaction oven is operated at a temperature between 200°C and 230°C. This temperature is exceptional for a single, i.e. a first, reaction oven. In the prior art, such low temperatures are only disclosed with respect to reactions ovens which are provided downstream relative to a first reaction oven operated at a higher temperature.

The newly applied *Laslo et al.* reference discloses in FIG. 10 and in the corresponding part of the detailed description of the invention, a method for isolating hydrogen sulfide from coke oven gas with subsequent recovery of elemental sulfur in a Claus plant, in which the hydrogen sulfide is removed from the coke gas by means of gas scrubbing and in which the hydrogen sulfide from the regenerated adsorption liquid is passed to the Claus plant. According to the common set up of a Claus plant, a Claus boiler

and a reaction oven (catalytic reactor 172) are provided. The tail gas from catalytic reactor 172 is cooled and passed via a collector tank 178, which is provided for the removal of liquid sulfur, through line 182 to equipment for further treatment. This equipment is not shown in FIG. 10 of *Laslo et al.* and is only described generally in col. 26, lines 15 to 19. As one option it is suggested to ***reduce*** and recycle hydrogen sulfide to the Claus reactor or adsorption column. The step of reduction is not described. As an example, hydrogen sulfide might be separated from the tail gas by any suitable means before only the separated, i.e. reduced, hydrogen sulfide is recycled to the adsorption column.

Contrary to this teaching, in the method according to Applicant's claims 1 as amended, *the process gas* leaving the reaction oven, after precipitation of the condense sulphur, is past back into the coke oven gas to be cleaned ahead of gas scrubbing, ***with a residual content of hydrogen sulphate that was not converted***, i.e. without further processing.

Furthermore, neither the conversion rate of hydrogen sulfide nor the operation temperature of the single reaction oven as specified in Applicant's amended claim 1 are disclosed or suggested in *Laslo et al.* With reference to a common Claus process, the specified conversion rate of only 80 to 85 % and the

specified temperature of the single reaction oven of between 200°C and 230°C are completely unusual.

The secondary references have been considered, but are believe to be no more relevant.

With respect to the secondary references to *Luinstra et al.* and *Hyde*, Applicant refers to the remarks presented in its previous responses, which remarks are not believed to have been fully considered. It is emphasized that *Luinstra et al.* always refers to a rigid permeable catalyst structure.

Hyde discloses checker bricks used for recovering heat in recuperators (*See Hyde* col. 1, lines 7 to 8). It is emphasized that directly in the Claus boiler itself, a recovery of heat is neither provided nor reasonable as a sufficient temperature is needed to react the hydrogen sulfide with oxygen in the air. Furthermore, there is no disclosure or suggestion to use the checker bricks disclosed by *Hyde* in a Claus boiler. Moreover, it is also believed that the checker bricks disclosed in *Hyde* are not suitable to delimit a catalyst material as the space between the checker bricks is very large and would not retain catalyst bulk material. Accordingly, the catalyst material would penetrate between the checker bricks or even get into the boiler. In addition, bulk material would accumulate right between the

checker bricks and could not be removed. In other words, the free spaces defined between the checker bricks would be much to large.

Hyde also teaches the stacking of several layers of checker bricks (see FIG. 4), wherein the checker bricks are provided to define *vertical flues* (*See Hyde* col. 4, lines 61 to 62). In contrast to this teaching, Applicant's method as recited in amended claim 1 provides boiler lines with refractory material, laying horizontally. Accordingly, the gas flows in a horizontal, and not a vertical direction. Against this background the person skilled in the art would not consider combining the teaching of *Hyde* with *Luinstra et al.*

Thus as set forth above, the checker bricks disclosed in *Hyde* are not suitable for a Claus boiler. Rather, the checker bricks disclosed in *Hyde* are used for the recovery of heat in recuperators, wherein the checker bricks are provided to define vertical flues. Finally, the checker bricks presented in *Hyde* are not suitable to delimit a catalyst material as the space between the checker bricks is very large and would not retain catalyst bulk material.

The newly cited *Reed* reference discloses a system including two conventional Claus reactors and two cold bed adsorption

reactors. This means that four reaction ovens (Claus reactors) are *always* provided.

According to col. 1, line 33-34 of *Reed*, recovery levels of the Claus plant in the range of 97-99 % are desired. Against this background it is an aim of *Reed* to significantly improve the sulphur recovery level in a modified Claus process (*see e.g.*, col. 2, lines 26-27). Accordingly, a complicated arrangement of the process gas leaving the Claus burner in at least four reaction ovens is provided.

Based upon the teaching of *Reed*, a person skilled in the art would not consider using only a single reaction oven with an overall very low recovery level of only 80 to 85 %, as such an approach would be completely contrary to the essential purpose specified in *Reed*. Moreover, *Reed* provides that a first catalytic Claus reactor is operated in the range of 232°C to 343°C. A lower temperature of only 177-216°C is disclosed only with respect to a second catalytic reactor (which is downstream from the first catalytic reactor), wherein the second catalytic reactor is provided for additional elemental sulphur removal. Nevertheless, the main amount of hydrogen sulfide is converted in the first reaction oven operated at higher temperatures.

Accordingly, based upon the teachings of *Reed*, a person

skilled in the art would not contemplate using only a **single** oven operated in a temperature range between 200°C and less than 230°C as specified in Applicant's amended claim 1. Moreover, a conversion level of 80 to 85 % of the complete Claus plant, as specified in Applicant's amended claim 1, is not disclosed or suggested by *Reed*, in which an optimized conversion level of more than 99 % is expressly aspired (col. 10, lines 35-55).

The remaining secondary references to *Heisel et al.* and *Hatta et al.* have been considered, but are believed to be no more relevant.

In view of the foregoing amendments and remarks, it is respectfully submitted that the cited references, whether considered alone or in combination, fail to disclose or suggest a method for isolating hydrogen sulfide from coke oven gas as set forth in Applicant's amended claim 1.

In summary, claim 1 has been amended and claim 2 has been canceled without prejudice. In view of the foregoing, it is respectfully submitted that claim 1, together with claims 4-6 which depend thereon, are patentable over the cited references.

It is respectfully requested that the claims be allowed and that this application be passed to issue.

Respectfully submitted,
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